ABSTRACTS: SMALE SPACES, THEIR GROUPOIDS AND C*-ALGEBRAS

Dina Buric,
Splitting factor maps into s-bijective and u-bijective maps
In 1970, Bowen showed that an irreducible Smale space is a factor of a shift of finite type by showing that it has Markov partitions. Putnam extended Bowen's theorem by showing that every irreducible Smale space has a factor map that can be split into a s-bijective and u-bijective map; thereby defining a more refined model of the Smale space on its characterizing expanding and contracting spaces separately. We define two new constructions of Markov partitions for hyperbolic toral automorphisms inspired by the work of Adler, Weiss, and Praggastis. With one of the constructions, we investigate when a factor map from a shift of finite type to a hyperbolic toral automorphism can be written as a composition of a s-bijective and u-bijective map and we show that if such a splitting exists then the Markov partition must satisfy a Border Continuity condition. The second construction can be thought of as an explicit example of Putnam's theorem for the case of hyperbolic toral automorphisms whose defining matrix is in dimension 2 and has positive entries. We define a full splitting for all such hyperbolic toral automorphisms with one exception; the Arnold Cat map.

Rachel Chaiser (CU Boulder),
Wieler Solenoids from Flat Manifolds Part 1: The Stable Groupoid
We discuss the stable groupoid of Smale spaces obtained as the inverse limit of a flat manifold Y with a locally expansive self-cover. The stable groupoid for these systems is an inductive limit of groupoids each Morita equivalent to Y, which allows us to compute the K-theory of the associated groupoid C*-algebra as well as the groupoid homology. Using Proiett–Yamashita's isomorphism between the groupoid homology and Putnam's homology, we obtain a wealth of examples of Putnam?s homology and some general results on the torsion groups that can occur.

Dimitris Gerontogiannis (Leiden University),
K-homological finiteness of Ruelle algebras
Ruelle algebras are simple, purely infinite C*-algebras from Smale spaces, considered as higher dimensional Cuntz-Krieger algebras. This talk is about the K-homological finiteness of Ruelle algebras exhibited at the level of Fredholm modules. This allows to study index theory on Ruelle algebras through noncommutative geometry. The proof has two main parts: the computation of Kasparov slant products with the fundamental class of Kaminker-Putnam-Whittaker and the construction of smooth subalgebras of Ruelle algebras. I will provide a brief overview on K-homological finiteness and hope to present the proof in an elementary manner.

Levi Lorenzo (CU Boulder),
Wieler Solenoids from Flat Manifolds Part 2: The Unstable Groupoid
In this talk, we discuss the unstable groupoids of Smale Spaces obtained as inverse limits of locally expansive covering maps on flat manifolds. In these systems, the local unstable sets are homeomorphic to $\mathbb{R}^n$, the universal cover of the flat manifold. By restricting the unstable relation to a local stable set, we obtain a Morita equivalent groupoid isomorphic to the orbit equivalence groupoid of an odometer system, of which the homology and the K-theory of the associated C*-algebra are known.

Brady Killough (Mount Royal University),
Ring and Module Structures on K-theory of C^*-algebras from Smale Spaces
In this talk we will briefly review the Stable (S), Unstable (U), and Homoclinic (H) algebras associated to an irreducible Smale Space, (X, φ), as well as the $*$-automorphism arising from the dynamics on the Smale space (α). This $*$-automorphism satisfies several asymptotic commutation relations, which in turn allow for a product to be defined on the K-theory of the mapping cylinder of the Homoclinic algebra (CH) (i.e. $K_*(CH)$ is, in fact, a ring). $K_*(S)$, $K_*(U)$, and $K_*(H)$ are then modules over $K_*(CH)$. In the case of a shift of finite type, we can explicitly describe these ring and module structures in terms of the appropriate inductive limits. In the shift of finite type case we are also able to show that $K_*(S)$ and $K_*(U)$ exhibit a certain duality in the sense that $\mathrm{Hom}_R(K_*(S), R) \cong K_*(U)$, where R is an appropriate subring of $K_*(CH)$.

Much of this is due to Ian Putnam, and none of it is particularly new.

Valerio Proiett (East China Normal University),
Homology of groupoids and Smale spaces
I will present results identifying the homology of Smale spaces to the homology of their associated étale groupoids, going beyond the ample case (which corresponds to non-wandering Smale spaces with totally disconnected stable sets). Along the way we will discuss a Poincaré duality-type result and some K-theory approximations based on simplicial homotopy methods. This is joint work (in progress) with M. Yamashita.

Andrew Stocker (CU Boulder),
Expansive Systems and their C*-Algebras
Expansive systems are a class of topological dynamical systems which exhibit sensitivity to initial conditions. Following work by Klaus Thomsen, we will construct a C*-algebra from an asymptotic equivalence relation on the points in a given expansive system. This generalizes the C*-algebraic construction made by Ian Putnam for Smale Spaces, which are themselves an important special case of expansive systems. We will then present some results obtained for a type of expansive system called synchronizing systems, and we will compute this C*-algebra for some specific examples.

Karen Strung (Institute of Mathematics of the Czech Academy of Sciences),
Dynamic asymptotic dimension of groupoids associated to Smale spaces and nuclear dimension of their C*-algebras
Guentner, Willet and Yu introduced a notion of dimension for étale principal groupoids called "dynamic asymptotic dimension". This generalised the Rokhlin dimension for group actions, as well as other notions of dimension. In certain situations, one can use the dynamic asymptotic dimension of a groupoid to bound the so-called "nuclear dimension" of the associated groupoid C*-algebra. In this talk, I will show that the dynamic asymptotic dimension of the stable and unstable equivalence relations of a mixing Smale space is always finite. This is then used to deduce that the C*-algebras of the homoclinic, stable, and unstable equivalence relations have finite nuclear dimension. In particular, they can be classified by K-theory. (Joint work with Robin Deeley.)

Mike Whittaker (University of Glasgow),
An introduction to Smale spaces, their groupoids, and C*-algebras
I will introduce some fundamental examples of Smale spaces and also discuss the general construction of étale groupoids associated to a mixing Smale space.